

1

Thales and Natural Causation

Blessed is he who has learned how to engage in inquiry,
with no impulse to harm his countrymen or to pursue wrongful actions,
but perceives the order of immortal and ageless nature, how it is structured.

—*Euripides*

In the beginning was a question. Twenty-six centuries ago Thales (c. 624 B.C.—c. 547 B.C.), a citizen of the Greek colony of Miletus, asked, “What is the world made of?” With that question, and by his insistence that it not be answered by a story about the gods, Thales planted the seed that would grow into Western science. The answer he gave was unsatisfactory, as his pupil Anaximander soon pointed out. Yet, by basing his speculations on observation and reason rather than revelation, Thales invited others to criticize his ideas and offer arguments and answers of their own. Anaximander was the first to accept that invitation. The dialogue they began—marked by an open clash of competing ideas, and with the ultimate appeal not to the whims of the gods but to nature and reason—marks the birth of science.

We know little about Thales. Historians conjure up the dates of his birth and death from events that took place during his life. He was born in Miletus, then a bustling regional center on the southern coast of what is now Turkey. His father was a Carian named Examyas, his mother, Cleobuline, was probably Greek. Miletus’s cultural roots lay in mainland Greece, but it thrived because of trade throughout Asia

Minor and the Middle East. Thales appears to have been a man of affairs. He seems to have traveled widely, and is credited with being the first to bring geometry and astronomy to Greece from already ancient Egypt. He is reputed to have been an engineer who was able to change the course of a river so that an army could cross it. The later Greeks listed Thales as one of their Seven Sages. Like those other revered figures, his expertise included politics. The farsighted Thales warned the Ionians that they needed to unite to defend themselves against the Persians. Ionia remained divided and fell to the Persians fifty years after Thales's death.

Plato and Aristotle tell two very different stories about Thales. With a suspicious wealth of detail, Plato writes, "Theodorus, a witty and attractive Thracian servant girl, is said to have mocked Thales for falling into a well while he was observing the stars..." That would make Thales both the first philosopher and the first absent-minded one. In contrast, Aristotle tells us that, based on his knowledge of astronomy, Thales was able to predict a bumper crop of olives and parlay that prediction into a fortune by gaining control of the region's oil presses. That would make him the world's first scientist-entrepreneur.

Absent-minded or shrewd—we can't be sure, but we do know that Thales was the first person we can name who asked a fundamental question about nature and answered it on strictly natural terms. Long before anyone had thought of atoms, before there were words for matter, science, or even philosophy, Thales sought to know what the world was made of. He refused to rest with how things seemed. He believed that mountains and seas, plants and animals, wind and rain—all the things we perceive—stem from a common source. And, crucially, he was not willing to accept an answer invoking the gods or anything else above or apart from nature. An angry Zeus was not the source of thunder and lightning, nor was "broad-bosomed Earth" created by Chaos. Thales was a politician and engineer. To his practical mind, everything must have evolved or differentiated from something real, something he could see and touch.

Aristotle restated Thales's great insight two and a half centuries later: "For there has to be some natural substance, either one or more than one, from which the other things come to be, while it is preserved." The choice Thales made for that primordial substance was water. We don't know why. Aristotle speculated that Thales looked at creation biologically, observing that all living things contain water, and that the processes of insemination and nutrition involve moisture.

But, as we'll see, Aristotle was fascinated by living things, a fascination there is no evidence that Thales shared. It's equally likely that Thales observed the different physical states of water—solid, liquid, and mist or vapor, and reasoned that this protean substance could account for all the varied things of the world.

As bold as he was, Thales could not divorce himself totally from ancient traditions. He found it difficult to explain the movement of wind and water, lodestones and living things, on the basis of substance alone. But he also refused to look for the source of nature's dynamism outside of nature. Instead, he invested everything with a kind of life force. Later philosophers would call Thales and his followers *hylozoists*—those who believe everything is alive.

Thales went on to create a model of the universe—the first strictly physical cosmology. Earth, he thought, had formed from the primordial waters, like the Egyptian delta emerging from the Nile. He conjectured that the Earth was a flat disk, floating like a log. Earthquakes, sensibly, were caused by waves in the surrounding waters. The heavens were circled by a great river, with the sun, moon, planets, and stars being blown across the sky by winds stirred by the water's circulation.

Anaximander, Thales's brilliant pupil, soon devised a much more sophisticated picture of the cosmos. But he addressed the same kind of questions Thales asked. What is the world made of? How did it develop? What keeps the Earth in place? In turn, Anaximander's student Anaximenes criticized both his predecessors and developed his own models and explanations. However much these first philosophers differed, they shared two beliefs: nature must be understood without resorting to supernatural causes, and humans are capable of discovering nature's truths through observation and reason.

As if it were not enough to have invented scientific inquiry, Thales was also celebrated as an astronomer. The most hotly debated of his feats is his supposed prediction of a solar eclipse that marked the end of a long war between the Lydians and the Medes. Both ancient and modern writers rightfully saw this as a remarkable accomplishment—one that other astronomers would not be able to duplicate for centuries. The Roman historian Herodotus repeated the story, which he derived from earlier sources. The eclipse in question must have occurred during the Forty-ninth or Fiftieth Olympiad (between 585 and 577 B.C.). In the nineteenth century, astronomers calculated that a total eclipse of the sun had in fact darkened the skies of Ionia on May 28, 585 B.C. That, they believed, was Thales's eclipse.

Until recently, most historians accepted the story. They assumed that Thales had gleaned astronomical knowledge from the Egyptians that enabled him to foretell the time and place of the eclipse. Scholars knew, for example, that in the second century A.D. the great astronomer Ptolemy studied Babylonian eclipse records dating back to 747 B.C. Today, however, with much greater knowledge of ancient astronomy, historians of science are convinced that the best the Babylonians or Egyptians could do was to identify periods when solar eclipses were possible somewhere on Earth. However good their records, they could not predict that a solar eclipse would definitely take place, much less pin it down to a particular locale. In light of the olive-press story, it's not difficult to imagine that Thales might have been enough of a risk-taker to predict an eclipse even if he was far from sure of being right. Still, scholars today suggest we reverse our understanding of the tale: Thales didn't become famous because he foretold an eclipse. Rather, later writers attributed the prediction to him because of his fame. It's almost certainly a myth, like the story of George Washington throwing a silver dollar across the Potomac.

Putting the stories aside, Thales still stands as a heroic figure, a true culture-giver. Even if all he did was to see past the bewildering variety of what we perceive, to ask what all things are made of, he would deserve his fame. But by insisting that the answer must be found within nature, not above it, he gave us our first scientific tools. The classical scholar G. E. R. Lloyd credits Thales with nothing less than "the discovery of nature."

Far more remarkable than any story about Thales is the fact that twenty-first-century physicists, wielding the most powerful experimental tools ever devised, are simply attempting to complete what Thales started 2,600 years ago. By blasting atoms together with enormous energy they are recreating the conditions that existed an instant after creation—a time when all the forces of nature were unified and matter was reduced to its fundamental constituents. Aristotle described the goal that Thales and all his followers sought:

that from which all things are, and out of which all things come to be in the first place, and into which they are destroyed in the end—while the substance persists, but the qualities change—this, they say, is the element and first principle of things.